

L158.007

## PATENT SPECIFICATION



DRAWINGS ATTACHED

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## COMPLETE SPECIFICATION

## Dish-Washing Machine

We, ROWENTA METALLWARENFABRIK GMBH, a Company of The Federal Republic of Germany, of Waldstrasse 232, Offenbach am Main, The Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

5 To-day, it is frequently usual to equip dish-washing machines with a water softener. It has actually been found that the hardness of tap water is so high in many districts that the hardness of the water caused precipitation of salts at the temperatures used in the dish-washing machine. The precipitation and deposition of salts during the drying of the dishes, which leads to clearly visible spots, may be mentioned as a disadvantage.

10 The water softeners used in conjunction with dish-washing machines generally work with ion exchangers. Now in order always to be able to prevent the precipitation of the salts causing hardness, it is necessary to know when the ion exchanger is exhausted in order to be able to regenerate the ion exchanger or to replace it. If the hardness of the water and the water consumption per washing operation are known and if it is assumed that the hardness of the water remains constant then it is sufficient to regenerate the ion exchanger after a specific number of washing operations. On the basis of these assumptions, it has already been proposed that the regeneration of the exchanger should be controlled automatically by the programmed control of the machine. This proposal cannot be satisfactory, however, because on the one hand the hardness of the water differs from place to place so that the timing and duration of the regeneration would always have to be freshly set. Nor is it correct to assume that the hardness of the water remains constant. Instead it varies with the seasons and sometimes to a very great extent. With such water

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conditions, therefore, the difficulty arises of regenerating the ion exchanger precisely at the right moment because with premature regeneration brine is wasted and frequently has to be replenished and because if the regeneration is too late, the salts causing the hardness have already been precipitated. In irreversible ion exchangers, on the other hand, ion exchange material is wasted in the event of premature replacement, that is to say taking place before the exchanger is exhausted.

According to the invention, the difficulties outlined above are overcome by the inclusion in a dish-washing machine of a water softener comprising or associated with a container connected into a water supply pipe in the machine and containing an ion-exchange substance which contains at least a proportion of an indicator resin. The resin indicates, by a change of colour, when the ion-exchange substance is exhausted so that the user can determine the moment of regeneration or of replacement of the ion-exchanger substance by the change of colour. This change of colour may be observed by means of an inspection glass or the like which is mounted at a point where there are also the other supervisory and control devices for the dish-washing machine, for example on a batten at the front of the dish-washing machine.

The container for the ion-exchange substance and the indicator resin may constitute the softener. Since the softener is generally accommodated, however, at a point inside the housing of the dish-washing machine which is difficult of access from the outside, it is preferably to provide a separate small indicator vessel downstream of the actual softener at a suitable easily accessible point of the machine.

It is an advantage to use a reversible indicator resin, that is to say a resin which can be regenerated. When such an indicator resin is exhausted and a change of colour has taken place, the colour of the resin changes again during the regeneration and the resin resumes

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its original colour. It is also possible to use an irreversible resin, however. Then it is an advantage to construct the indicator vessel in the form of a replaceable cartridge.

The change of colour in the indicator resin may also be used to control the regeneration of the ion exchanger automatically, for example photoelectrically by means of a photoelectric cell. This may be carried out in such a manner that an electro-magnetic valve opens the connection to a brine container and closes again after regeneration is complete, in which case a pump may also be switched on and off. The subject of the invention is illustrated by way of example and purely diagrammatically in the drawings, in which:—

Figure 1 shows the dish-washing machine in front elevation;

Figure 2 shows the indicator vessel constructed in the form of a replaceable cartridge and the relationship of the photoelectric cell thereto; and

Figure 3 shows the relationship between the indicator vessel and the softener, and the control of the automatic regeneration.

As can be seen from Figure 1, a plurality of push-buttons 2 for the selection of the dish-washing programme are provided at the front of the dish-washing machine on the batten-like control panel 1. In addition, an indicator 3 for the progress of the washing programme is mounted in the control panel as well as drawers 4 for detergent and/or wetting agent and/or common salt. The indicator vessel for the regeneration of the softener is designated at 5. As can be seen from Figure 2, the indicator vessel is constructed in such a manner that it can be removed from the control panel of the machine by unscrewing the two retaining nuts 6 and 7. The photoelectric cells 8 and 9 react to the change of colour of the exchanger resin in the indicator vessel.

As can be seen from Figure 3, the indicator vessel 5 is connected to the softener 10. The hard-water inlet to the softener is designated at 11, the soft-water outlet at 12. A washing-water outlet is indicated at 13 but is not absolutely essential for operation. It is used when washing water is intended to remove the residues of common salt from the exchanger after the regeneration of the softener. A solenoid valve 14 is provided to control this outlet.

The control of the inlet and outlet for the hard and soft water is provided by a multi-way valve 15. At 16 there is designated a brine mixer and in the pipe connecting this to the softener there is connected a pump 17 with an electric drive 18. During dish washing softened water is supplied from hard water from the inlet 11 which passes through the valve 15 and the softener 10 (the valve 14 being closed), and thence through the pump 17 and

the indicator vessel 5 to the outlet 12. When the exchanger resin in the indicator vessel 5 undergoes a change of colour a current is generated in the photoelectric cells 8 and 9, which current, through a relay 19, closes a switch 20 in the circuit of the pump drive 18. The control circuit for the photoelectric cells is preferably fed from a different voltage source from the circuit of the pump drive. The valve 15 is then closed and brine from the mixer 16 is delivered by the pump 17 through the softener 10 in the opposite direction to that of the flow during softening and out through the valve 14 which is opened and the outlet 13. The pump 17 could also be constructed in the form of a water-jet pump; the drive 18 is then used to control a valve in the connecting pipe between the brine mixer 16 and the softener 10. The valve 15 can also be set to direct a flow of water from the inlet 11 through the vessel 5, the pump 17, the softener 10 and the valve 14 to the outlet 13 to remove salt residues from the exchanger as previously mentioned.

#### WHAT WE CLAIM IS:—

1. A dish-washing machine having a water softener comprising or associated with a container which is connected into a water supply pipe in the machine and contains an ion-exchange substance, characterised in that the ion-exchange substance contains at least a proportion of an indicator resin.
2. A dish-washing machine as claimed in claim 1, characterised in that the ion-exchange substance consists entirely of indicator resin.
3. A dish-washing machine as claimed in claims 1 and 2, characterised in that the container is constructed to function as an indicator vessel and is connected in series with a further container which is filled with an ion-exchange substance and constitutes the water softener.
4. A dish-washing machine as claimed in claim 3, characterised in that the indicator vessel is constructed in the form of a replaceable cartridge.
5. A dish-washing machine as claimed in claims 4 or 5, characterised in that the indicator vessel is mounted in the control panel of the dish-washing machine.
6. A dish-washing machine as claimed in any of claims 1 to 5, characterised in that photoelectric cells are provided therein for, detecting the change of colour in the indicator resin and controlling the regeneration of the water softener.
7. A dish-washing machine as claimed in any of claims 1 to 6, characterised in that the indicator resin is reversible.
8. A water-softening device in a dish-washing machine constructed and arranged substantially as hereinbefore described and shown in the accompanying drawings.

J. BENNETT & CO.,  
Chartered Patent Agents.  
Nascott House,  
26 Bath Road, Slough,  
Buckinghamshire.  
Agents for the Applicants.

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Fig. 1

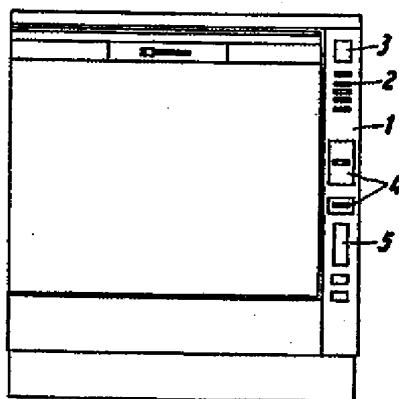
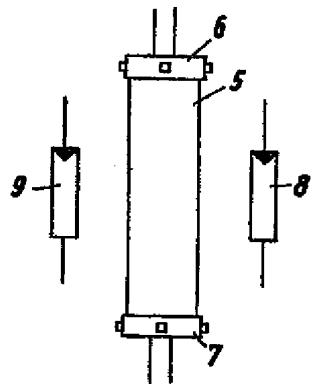


Fig. 2



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Fig. 3

